**ALKALI METALS**

* + All the metals in group 1
  + They all have an electron configuration of ns1 where n is the energy level, so for example lithium is [He]2s1
  + Since the last element in this group is francium and it is radioactive, it is disregarded here
  + They are silvery and shiny, they can be easily cut into and they lose their color when they are oxidized
  + They are very reactive and the reactivity increases as we go down to cesium
  + They are very similar to each other in terms of properties, much more than any elements in the other groups are to each other
  + They are too reactive to be found in free nature and are usually found in sea beds (sodium), or molten salt states (potassium- they have to be electrolyzed to obtain them)
  + The oxidation numbers are always 0 or +1
  + They are different form other metals in several ways:
    - Soft
    - Low melting temperature
    - Low boiling temperature
    - Low densities (Li, Na, K have densities less than that of water)
    - Weak metallic bonding (since only one electron is available from each atom)
    - Color flames (the outermost energy level is promoted to a higher level, the electrons are excited)
    - Ionic radii is very small
  + They are strong reducing agents
  + They form ionic solid oxides
  + The aqueous solution of alkali metals are strongly alkaline or basic in nature
  + The first ionization energy of these elements is very low and the second is very high. This is because the outer most electron shell is well shielded by the shells before it that protect I from the nucleus's attraction so it is easier to remove
  + The ionization energy decreases down the group
  + They are formed from various very important industrial chemicals (sodium hydroxide, sodium chloride and sodium carbonate- they are mostly byproducts of certain processes)

Alkaline Earths

The alkaline earth metals consist of Beryllium, Magnesium, Calcium, strontium, Barium, Radium. Magnesium is the 8th most abundant element on earth and Calcium is the fifth. They are also very reactive and since they are so reactive they are not found on earth just as elements. There physical properties are that they are shinny silver metals. They are harder and denser than group 1 and also have a higher melting point this is because they have two valence electrons which leads to stronger bonds. There ionic radii and atomic radii increase as they go down the group. They are also very reactive and since they are so reactive they are not found on earth just as elements. All of the metals except for beryllium form with oxygen in the air at room temperature. The oxides of these metals have the general formula MO and are basic. Calcium, strontium, and barium oxides react with water to form hydroxides. All of the metals have an oxidation number of +2 and their compounds are usually ionic. Industrial uses. Magnesium is the only one used on a large scale it is used in flares, bombs, and tracer bullets. Also used in aircraft when it is alloyed with aluminum. The melting point decreases as you go down the group also ionization energies also decrease as you go down the group

**Halogens**

* End in Xp5 configuration
* Highly electronegative (high electron affinity)
  + Higher with Fluorine, therefore
    - AlCl3 is covalent
    - AlF3 is ionic
* Diatomic F2, Cl2, Br2, I2
* Oxidation Numbers – most commonly odd numbers
  + Fluorine always has an oxidation number of -1 in compounds
  + Others can vary (ex. Cl5+, Cl7+, Cl-, etc)
* Compounds with Oxygen = Acidic Oxides
  + No fluorine oxides bc more electronegative than oxygen
* Compounds with Hydrogen = Covalent
  + Dissolve easily to give acidic solutions
* Too reactive to be found in nature as elements (not as diatomic or in compounds)
* Cl and Br found in large quantities in salt-water
* Industry:
  + F – used as an oxidizing agent (forces other elements to lose electrons, ex, Fe2+ 🡪 Fe3+ + 1e-)
  + Cl – used for chlorinating (sterilizing) drinking water and DDT (insecticide) and bleach

|  |  |  |
| --- | --- | --- |
| **Decreasing Trends**  **(F is highest)** | **Decreasing Trends**  **(F is lowest)** | **Halogen Elements** |
| Electronegativity  Ionization Energy   * 1st, 2nd, 3rd, 4th   Reactivity  Oxidizing Ability | Melting Point  Boiling Point  Atomic Radii  Ionic Radii  Atomic Number  Atomic Mass  Boiling Point  Density | Fluorine – F |
| Chlorine – Cl |
| Bromine – Br |
| Iodine – I |
| Astatine - At |

**Noble Gases**

**Elements:**

* Helium
* Neon
* Argon
* Krypton
* Xenon
* Radon

**Reactivity:**

* Unreactive, full outer shell

**Occurrence and Extraction:**

* Found in minute quantities in the atmosphere
* Isolated by fractional distillation of liquid air

**Physical Properties:**

* Gases monatomic.
* Boil at low temperatures as only dispersion forces act between the atoms.
* Atomic radii increase on descending the Group.

**Chemical Properties:**

* Previously called the "inert gasses".
* Helium, neon and argon form no compounds
* Krypton forms a compound with fluorine.
* Xenon forms several compounds with oxygen and fluorine.

**Oxidation states and Ionization Energy:**

* Ionization energy increases on descending group.
* Valence shell becomes further away from the nucleus and electrons easier to remove.
* First ionization energy of xenon is comparable with that of bromines.